

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**Validation of a Newly Developed Eating Habits  
Questionnaire for New Zealand Women**

**A thesis presented for the partial fulfilment of the  
requirements for the**

**Degree of  
Master of Science  
In  
Human Nutrition  
At Massey University, Auckland  
New Zealand**

**Sarah Catharina Philipsen**

**2015**



## Abstract

**Background:** Eating habits can be defined as behavioural eating patterns that become an automatic response after repeat performances. Poor eating habits are a contributing factor to obesity, a major health concern worldwide and in New Zealand (NZ). Young women particularly, are at risk of developing poor eating habits as they make lifestyle changes, often unhealthy, following greater independence. Once habits are formed, they can continue throughout adulthood, often resulting in poor health outcomes. In order to determine and change eating habits, it is important that appropriately validated tools, of which there are none in NZ, are available to assess eating habits.

**Aim:** To develop and validate an eating habits questionnaire (EHQ), which assesses the usual eating habits of NZ women, including habitual intake, types of foods consumed, food combinations and the timing of meals and snacks.

**Methods:** An online self-administered EHQ was developed and validated against a 4-day weighed food record (WFR) in women aged 16-45 years (n=108), living in Auckland, NZ. The EHQ focused on eating habits linked with obesity and excess body fat including behaviours associated with healthy/unhealthy eating, social occasions, the time distribution of meals and snacks and typical foods consumed for these eating occasions. Validity was assessed between the EHQ and WFR using cross-classification analysis, and the weighted kappa statistic (Kw).

**Results:** Agreement from cross-classification between the EHQ and WFR ranged from 60.2% to 87.0% for snack foods; reached 91.0% for beverages between meals; was >50% for the behaviours of eating fried foods and takeaways, with Kw ranging from 0.21 to 0.33; and was >50% for low fat milk, meat and cheese. Agreement between the EHQ and WFR for the top five foods consumed for main meals ranged from 54.6% to 93.4% and for snacks ranged from 52.8% to 92.6%. Common foods consumed for breakfast were dairy, grains and basic sandwich; for lunch were non-starchy vegetables (NSV), meat and bread; and for dinner were NSV, meat and grains. Typical snack foods were fruit, tea and coffee, dairy, grains, baking and chocolate, with snacks most

common between lunch and dinner. Agreement between the EHQ and WFR ranged from 51.8% to 94.4% for the top two food combinations consumed for main meals, and from 83.3% to 99.0% for food combinations consumed for snacks. Typical food combinations reflected those food items consumed for main meals. Common food combinations for breakfast were 'dairy + grains', 'dairy + grain + fruit' and 'bread-based foods'; for lunch were 'bread-based foods', 'leftover combinations' and 'takeaway combinations'; and for dinner were 'meat + grain + NSV', 'meat + SV + NSV' and 'takeaway combinations'. 'Dairy + grains' were the only food combination commonly eaten as a snack.

**Conclusion:** The EHQ is a valid tool for assessing the usual eating habits that potentially contribute to obesity and excess body fatness in 16-45 year old NZ women. Further research is warranted to investigate the eating habits of a larger group of women to identify areas where nutrition education could be targeted as well as associations with health and chronic disease.

## **Acknowledgements**

There are a number of people who I would like to acknowledge, as without their support this research would not have been possible.

Firstly I would like to thank my supervisors Associate Professor Rozanne Kruger and Dr Kathryn Beck for their invaluable support, encouragement, advice and attention to detail throughout the whole process and writing of this thesis.

Thank you to AJ Hepburn and Zara Houston for all your help in entering the food records into FoodWorks and to AJ who additionally helped with coding of the EHQ. Also to Chelsea Symons for her help in coding the EHQ.

I would like to acknowledge everyone who helped with the EXPLORE study, especially Wendy O'Brien and Shakeela Jayasinghe for all their hard work in recruiting and co-ordinating the participants. Also to Beatrix Jones for her advice on statistical analysis.

Thank you to all the women who volunteered for this study. Your time and effort is very much appreciated.

Finally I would like to thank my family and friends for all their support and encouragement. Also to my classmates for their moral support and advice.

# Table of Contents

<b>Abstract</b> .....	<b>i</b>
<b>Acknowledgements</b> .....	<b>iii</b>
<b>Table of Contents</b> .....	<b>iv</b>
<b>List of Figures</b> .....	<b>vii</b>
<b>List of Tables</b> .....	<b>viii</b>
<b>Abbreviations</b> .....	<b>ix</b>
<b>List of Appendices</b> .....	<b>xii</b>
<b>Chapter 1: Introduction</b> .....	<b>1</b>
1.1 Background .....	1
1.2 Statement of the problem .....	3
1.3 Purpose of the study .....	4
1.4 Aim .....	5
1.4.1 Objectives .....	5
1.5 Thesis Structure .....	5
1.6 Researchers' Contributions .....	6
<b>Chapter 2: Literature Review</b> .....	<b>7</b>
2.1 Eating habits defined.....	7
2.2 Eating habits linked with diet quality and poor health outcomes .....	8
2.2.1 Meal patterns .....	8
2.2.2 Distribution of energy and macronutrients throughout the day .....	20
2.2.3 General eating habits.....	25
2.2.4 Fruit and vegetable intake .....	33
2.3 Determinants of eating habits.....	35
2.3.1 Society .....	37
2.3.2 Community .....	38
2.3.3 Social environment .....	39
2.3.4 Individual factors.....	40
2.4 Health outcomes of eating habits .....	43
2.4.1 Definitions .....	43
2.4.2 Prevalence.....	44
2.4.3 Risk factors for obesity and body fatness .....	45
2.4.4 Consequences of obesity and body fatness .....	48
2.5 Assessment and validation of eating habits .....	49
2.5.1 Dietary assessment techniques .....	49
2.5.2 Validation of eating habit questionnaires .....	54

2.5.3	Validation of previous studies assessing eating habits .....	56
2.6	Summary.....	65
	<b>Chapter 3: Methodology.....</b>	<b>66</b>
3.1	Study design .....	66
3.2	Ethical Approval .....	66
3.3	Participants .....	67
3.4	Recruitment.....	67
3.5	Data Collection.....	67
3.5.1	Screening .....	67
3.5.2	Data collection .....	68
3.6	Data analysis .....	72
3.6.1	Eating Habits Questionnaire .....	72
3.6.2	Weighed food records.....	73
3.6.3	Validation.....	74
3.7	Statistical analysis.....	76
	<b>Chapter 4: Results.....</b>	<b>79</b>
4.1	Demographic characteristics .....	79
4.2	Eating habits questionnaire including validation against the food record .....	80
4.2.1	Views on weight status .....	80
4.2.2	Eating habits.....	85
4.2.3	Eating behaviours.....	90
4.2.4	Low fat alternatives.....	93
4.2.5	Social occasions.....	97
4.2.6	Time distribution .....	99
4.2.7	Eating habits across the day.....	105
	<b>Chapter 5: Discussion.....</b>	<b>128</b>
5.1	Participant characteristics .....	128
5.2	Participants' eating habits .....	128
5.2.1	General eating habits .....	128
5.2.2	Eating behaviours.....	130
5.2.3	Low fat alternatives.....	133
5.2.4	Social occasions.....	136
5.2.5	Meal distribution .....	136
5.3	Validation summary.....	144
	<b>Chapter 6: Conclusion .....</b>	<b>146</b>
6.1	Summary of findings .....	146
6.2	Strengths.....	150

6.3 Limitations ..... 152

6.4 Application of eating habits to the ecological model..... 154

    6.4.1 Society ..... 154

    6.4.2 Community ..... 155

    6.4.3 Social environment ..... 155

    6.4.4 Individual factors..... 156

6.5 Future research recommendations ..... 158

6.6 Conclusion ..... 160

**References:** ..... **162**

## List of Figures

Figure 2.1 Distribution of energy intake in pre-menopausal women.....	23
Figure 2.2 Distribution of carbohydrate intake in pre-menopausal women.....	24
Figure 2.3 Distribution of protein intake in pre-menopausal women.....	24
Figure 2.4 Distribution of total fat intake in pre-menopausal women.....	25
Figure 2.5 Proportion of New Zealand women that met the fruit and vegetable guidelines from the NNS and ANS.....	33
Figure 2.6 Proportion of New Zealand women that met the fruit and vegetable guidelines from Health Surveys.....	34
Figure 2.7 Ecological Model showing the factors that influence an individual's eating habits.....	36
Figure 2.8 Risk factors for obesity and body fatness.....	46
Figure 2.9 Development of Chronic Diseases of Lifestyle.....	48
Figure 3.1 Study flow for eligibility screening criteria.....	66
Figure 3.2 Flowchart of the study timeline.....	69
Figure 4.1 Reasons participants are dissatisfied with their current weight.....	81
Figure 4.2 Reasons for losing or gaining weight.....	83
Figure 4.3 Methods employed to control weight.....	85
Figure 4.4 Participants' snack choices.....	87
Figure 4.5 Number of foods participants regularly consumed as low fat alternatives from the EHQ.....	94
Figure 6.1 Application of the Ecological Model to participants' eating habits.....	157

## List of Tables

Table 1.1 Researchers' Contributions to the study .....	6
Table 2.1 Common foods eaten by adults for breakfast, lunch and dinner worldwide .....	10
Table 2.2 Food intake throughout the day and week in New Zealand families from health promotion research .....	13
Table 2.3 Common snack foods eaten worldwide .....	17
Table 2.4 Acceptable Macronutrient Distribution Ranges .....	21
Table 2.5 Country guidelines for energy distribution at meals and snacks .....	21
Table 2.6 Studies investigating the distribution of energy and macronutrients in pre-menopausal women .....	22
Table 2.7 Eating habits of New Zealand women from the NNS and ANS .....	26
Table 2.8 Classification of excess fat using BMI, waist circumference and waist to hip ratio .....	44
Table 2.9 Common techniques used to assess eating habits and dietary intake .....	50
Table 2.10 Qualitative assessment and validation of eating habits .....	57
Table 4.1 Demographic characteristics of participants .....	79
Table 4.2 Participants' views on weight status that may influence eating habits .....	80
Table 4.3 Participants' general eating habits .....	86
Table 4.4 Comparison of the EHQ and WFR for participants' snack choices .....	88
Table 4.5 Comparison of the EHQ and WFR for beverage consumption between meals .....	88
Table 4.6 Cross classification of alcohol consumption at meals between the EHQ and WFR .....	89
Table 4.7 Frequency of eating practice behaviours from the EHQ .....	90
Table 4.8 Comparison between EHQ and WFR on eating practice behaviours .....	91
Table 4.9 Energy, sugar, total fat (g and % energy) and saturated fat (g and % energy) intakes for different eating behaviours .....	92
Table 4.10 Food choice behaviour for low fat alternatives from the EHQ .....	93
Table 4.11 Comparison of the EHQ and WFR for low fat alternatives .....	95
Table 4.12 Energy, total fat (g and % energy) and saturated fat (g and % energy) intakes for different low fat alternatives .....	96
Table 4.13 Common social occasions attended, frequency of occasions and beverages consumed from the EHQ .....	98
Table 4.14 Comparison between the EHQ and WFR for the usual consumption of meals and snacks on weekdays and weekends .....	100
Table 4.15 Comparison between the EHQ and WFR for the time of day participants ate breakfast on weekdays and weekends .....	102
Table 4.16 Comparison between the EHQ and WFR for the time of day participants ate lunch on weekdays and weekends .....	103
Table 4.17 Comparison between the EHQ and WFR for the time of day participants ate dinner on weekdays and weekends .....	104
Table 4.18 Food categories and foods used to describe what NZ women eat throughout the day .....	106
Table 4.19 Foods and food combinations consumed for breakfast on weekdays and weekends .....	107
Table 4.20 Comparisons of food and food combinations consumed for breakfast on weekdays and weekends .....	109
Table 4.21 Foods and food combinations consumed for lunch on weekdays and weekends .....	111
Table 4.22 Comparisons of foods and food combinations consumed by participants for lunch on weekdays and weekends .....	113
Table 4.23 Food and food combinations consumed for dinner on weekdays and weekends .....	115
Table 4.24 Comparisons of food and food combinations consumed for dinner on weekdays and weekends .....	117
Table 4.25 Foods consumed as a snack between breakfast and lunch on weekdays and weekends ..	119
Table 4.26 Comparison of snacks and snack combinations eaten between breakfast and lunch on weekdays and weekends .....	120
Table 4.27 Foods consumed as a snack between lunch and dinner on weekdays and weekends .....	122
Table 4.28 Comparison of snacks and snack combinations eaten between lunch and dinner on weekdays and weekends .....	123
Table 4.29 Foods consumed as a snack after dinner on weekdays and weekends .....	124
Table 4.30 Comparison of snacks eaten after dinner on weekdays and weekends .....	126

## Abbreviations

ANS	2008/09 New Zealand Adult Nutrition Survey
AMDR	Acceptable Macronutrient Distribution Range
BF	Body Fat
BMI	Body Mass Index
B-EAT	Breakfast Eating Assessment Tool
CDL	Chronic Diseases of Lifestyle
CHO	Carbohydrate
CI	Confidence Interval
CVD	Cardiovascular Disease
DHQ	Dietary Habits Questionnaire
D-EAT	Dinner Eating Assessment Tool
EBPQ	Eating Behaviour Pattern Questionnaire
EHQ	Eating Habits Questionnaire
EO	Eating Occasion
ESQ	Eating Styles Questionnaire
EXPLORE	EXamining the Predictors Linking Obesity Related Elements
FDDR	Four Day Diet Record
FFQ	Food Frequency Questionnaire
FH	Food Habits
FR	Food Record

HNRU	Human Nutrition Research Unit
HUB	Healthy and Unhealthy eating Behaviours
ID	Identification Number
Kw	Weighted Kappa Statistic
L-EAT	Lunch Eating Assessment Tool
L-FAT	A Low Fat Alternatives Tool
NHANES	National Health and Nutrition Examination Survey
NNS	1997 National Nutrition Survey
NSV	Non-Starchy Vegetables
NZE	New Zealand European
NZHS	New Zealand Health Survey
NZ	New Zealand
n/a	Not Applicable
OREB	Obesity Related Eating Behaviours
PRO	Protein
SD	Standard Deviation
SES	Socioeconomic Status
SSB	Sugar Sweetened Beverages
STFHQ	SisterTalk Food Habits Questionnaire
SV	Starchy Vegetables
S-EAT	Snack Eating Assessment Tool

T2DM	Type 2 Diabetes Mellitus
UK	United Kingdom
USA	United States of America
WC	Waist Circumference
WEST	WEight SStatus
WFR	Weighed Food Record
WHO	World Health Organisation
WHR	Waist to Hip Ratio
yrs	Years
%BF	Percentage body fat
$\chi^2$	Chi-squared

## List of Appendices

<b>Appendix A: Eating habits questionnaire .....</b>	<b>182</b>
<b>Appendix B: 4-day Weighed Food Record.....</b>	<b>194</b>
<b>Appendix C: Coding the eating habits questionnaire.....</b>	<b>214</b>
<b>Appendix D: Coding the descriptive questions on food intake in the eating habits questionnaire and food record .....</b>	<b>227</b>
<b>Appendix E: Template used for coding the descriptive questions on food intake and the times meals are eaten in the eating habits questionnaire compared to the food record .....</b>	<b>235</b>
<b>Appendix F: Food categories used for the coding and validation of the eating habits questionnaire and food record.....</b>	<b>237</b>
<b>Appendix G: Food categories included under each food combination for breakfast, lunch and dinner.....</b>	<b>241</b>
<b>Appendix H: Assumptions used when coding the eating habits questionnaire and food record for validation .....</b>	<b>247</b>
<b>Appendix I: Food record FoodWorks assumptions .....</b>	<b>252</b>
<b>Appendix J: Recommended changes to the eating habits questionnaire ....</b>	<b>255</b>